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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/893,791

06/29/2001

Yutaka Kobayashi

PNDF-01068

4575

7590

10/21/2002

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EXAMINER

CHU, CHRIS C

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 10/21/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/893,791

Applicant(s)

KOBAYASHI, YUTAKA

Examiner

Chris C. Chu

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 08 July 2002.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1 - 4 and 14 - 20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 - 4 and 14 - 20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 June 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All   b) ☐ Some \*   c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)                      4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)                      5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_                      6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicant's amendment filed on July 08, 2002 has been received and entered in the case.

### ***Drawings***

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the following limitation in claim 18 with claim 4 "the semiconductor chip is provided with a chip-mounting substrate" must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

3. Applicant is required to submit a proposed drawing correction in reply to this Office action. However, formal correction of the noted defect may be deferred until after the examiner has considered the proposed drawing correction. Failure to timely submit the proposed drawing correction will result in the abandonment of the application.

*Claim Rejections - 35 USC § 112*

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claim 18 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claim 18, the original specification fails to disclose the combined limitation of claim 18, specifically, "a chip-mounting substrate" with claim 4.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claim 18 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 18, it can not be determined what applicant regards as the "chip-mounting substrate."

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1 ~ 3, 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over the acknowledged prior art of Fig. 1 in view of Enomoto et al.

The acknowledged prior art discloses in Fig. 1 a semiconductor device, comprising:

- a semiconductor chip (100);
- a chip-mounting substrate (103) which is provided with the semiconductor chip mounted on a top surface thereof and first conductive pads (107) formed on a bottom surface thereof and connected with the semiconductor chip electrically;
- solder balls (106) formed on the first conductive pads;
- a printed circuit board (104) on which second conductive pads (108) connected with the solder balls are formed; and
- underfill material (105) injected into a clearance formed between the chip-mounting substrate and the printed circuit board,

The acknowledged prior art does not disclose uneven roughness being formed on a surface of the printed circuit board. Enomoto et al. discloses in Fig. 1d uneven roughness being formed on a surface of a printed circuit board. It would have been obvious to one of ordinary

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skill in the art at the time of the present invention was made to use the uneven rough surface of the printed circuit board of Enomoto et al. in the device of the acknowledged prior art of Fig. 1 in order to provide an adhesive for the printed circuit board having excellent thermal resistance, electrical resistance, chemical stability and adhesion property to the printed circuit board as taught by Enomoto et al. in column 2, lines 43 ~ 48.

Regarding claim 2, Enomoto et al. discloses in Fig. 1d the uneven roughness being formed on the first conductive pads or on the second conductive pads selectively.

Regarding claim 3, Enomoto et al. discloses in Fig. 1d the uneven roughness being shaped into a slit-like configuration or into a dimple-like configuration.

Regarding claim 15, Enomoto et al. discloses in Fig. 1d the uneven roughness increasing an area of a contact surface between the chip-mounting substrate and an underfill material.

Regarding claim 16, Enomoto et al. discloses in Fig. 1d the printed circuit board having a dimple-like shaped configuration.

10. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over the acknowledged prior art of Fig. 1 in view of Enomoto et al. as applied to claim 1 above, and further in view of Oura et al.

The acknowledged prior art of Fig. 1 and Enomoto et al. disclose a claimed invention except for the uneven roughness existing on a bottom surface of the chip-mounting substrate. However, Oura et al. discloses in Fig. 34 an uneven roughness existing on a bottom surface of a chip-mounting substrate (191). It would have been obvious to one of ordinary skill in the art at

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the time of the present invention was made to use the uneven roughness surface of Oura et al. in the device of the acknowledged prior art of Fig. 1 and Enomoto et al. in order to increase adhesive strength as taught by Oura et al. in column 31, lines 15 ~ 17.

11. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over the acknowledged prior art of Fig. 1 in view of Enomoto et al. as applied to claim 1 above, and further in view of Kaskoun et al.

The acknowledged prior art of Fig. 1 and Enomoto et al. disclose a claimed invention except for a surface of said chip-mounting substrate having a slit-like shaped configuration. However, Kaskoun et al. discloses in Fig. 1 a surface of said chip-mounting substrate (13) having a slit-like shaped configuration. It would have been obvious to one of ordinary skill in the art at the time of the present invention was made to use the slit-like shaped configuration of Kaskoun et al. in the device of the acknowledged prior art of Fig. 1 and Enomoto et al. in order to decrease tacking pressure during the assembly process as taught by Kaskoun et al. in column 3, lines 62 ~ 63.

12. Claims 4, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kweon et al. in view of Sakuma et al.

Kweon et al. discloses in Fig. 2A a semiconductor device, comprising:

- a semiconductor chip (21);

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- a lead frame (23, 25 and 27) which is provided with the semiconductor chip mounted thereon and electrically connected with the semiconductor chip; and
- a printed circuit board (28) including third conductive pads (29), which are formed thereon and brought into direct contact with the lead frame.

Kweon et al. does not disclose at least one of the lead frame and the printed circuit board being provided with uneven rough contact surfaces in direct contact therebetween. Sakuma et al. discloses in Fig. 7 at least one of a lead frame (3) and a printed circuit board being provided with uneven rough contact surfaces in direct contact therebetween. It would have been obvious to one of ordinary skill in the art at the time of the present invention was made to use the uneven rough contact surfaces in direct contact between the lead frame and the printed circuit board of Sakuma et al. in the device of Kweon et al. in order to improve connection between the lead frame and the printed circuit board as taught by Sakuma et al. in column 3, lines 42 ~ 46.

Regarding claim 18, Kweon et al. discloses in Fig. 2A the semiconductor chip being provided with a chip-mounting substrate (23).

Regarding claim 19, Sakuma et al. discloses in Fig. 7 the uneven roughness existing on contact surfaces between a pad of said printed circuit board and an outer lead of said lead frame.

13. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over the acknowledged prior art of Fig. 1 in view of Kaskoun et al.

The acknowledged prior art discloses in Fig. 1 a semiconductor device, comprising:

- a semiconductor chip (100);



- a chip-mounting substrate (103) which is provided with said semiconductor chip mounted on a top surface thereof and first conductive pads (107) formed on a bottom surface thereof and connected with said semiconductor chip electrically, said chip-mounting substrate including wirings (102);
- solder balls (106) formed on said first conductive pads;
- a printed circuit board (104) on which second conductive pads (108) connected with said solder balls are formed; and
- material injected (105) into a clearance formed between said chip-mounting substrate and said printed circuit board.

Further, since the acknowledged prior art does not limit the material of wirings to any particular or specific material, hence his/her disclosure encompasses all well known material including "copper."

The acknowledged prior art does not disclose uneven roughness being formed on a contact surface between said Cu wirings of said chip-mounting substrate and said solder balls. Kaskoun et al. discloses in Fig. 1 uneven roughness being formed on a contact surface between said Cu wirings (17) of said chip-mounting substrate and said solder balls (12). It would have been obvious to one of ordinary skill in the art at the time of the present invention was made to use the uneven rough contact surface of Kaskoun et al. in the device of the acknowledged prior art of Fig. 1 in order to provide reliable contact as taught by Kaskoun et al. in column 2, lines 24 ~ 26.

***Response to Arguments***

14. Applicant's arguments filed on July 8, 2002 have been fully considered but they are not persuasive.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the motivation was clearly established by Enomoto et al. in column 2, lines 43 ~ 48 (to provide an adhesive for the printed circuit board having excellent thermal resistance, electrical resistance, chemical stability and adhesion property to the printed circuit board).

Further, applicant argues "the combination would not teach or suggest ... an uneven roughness formed on a surface." The argument is not persuasive because Enomoto et al. clearly shows in Fig. 1d uneven roughness formed on the surface.

Furthermore, applicant argues "[T]he heat resistant particles, ..., to form the recesses are an average particle size of 2-10  $\mu$ m. (see Column 3, lines 9 – 12). The recesses of a specific size range formed in the electroless plated film are structurally different than Applicant's uneven roughness on a surface without reference to any size range formed by mechanical grinding. Based on this structural difference, Enomoto does not teach or suggest Applicant's invention." This argument is not persuasive. Since the size range of recesses is wide (2-10  $\mu$ m), the recesses

of Enomoto read on as uneven roughness. Further, since the electroless plated film is part of a printed circuit board, the uneven roughness is formed on the surface of the printed circuit board.

Finally, the acknowledged prior art of Fig. 1 and Enomoto et al. are combinable because they are from the same field of endeavor that is semiconductor device, specifically, a printed circuit board.

On page 8, applicant argues “ it would not have been obvious to combine these references and even if combined, the combination would not teach or suggest each and every element of the claimed invention with an uneven roughness at contact surfaces in direct contact.” The argument is not persuasive. Sakuma et al. clearly discloses in Fig. 7 uneven rough contact surfaces (4) in direct contact with a circuit board (1).

Further, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). Contrary to applicant's assertion and as stated in the rejection, motivation was clearly established by Sakuma et al. in column 3, lines 42 ~ 46 (to improve connection between the lead frame and the printed circuit board).

Finally, Kweon et al. and Sakuma et al. are combinable because they are from the same field of endeavor that is semiconductor device (IC chip is known and called as semiconductor chip).

***Conclusion***

15. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chris C. Chu whose telephone number is (703) 305-6194. The examiner can normally be reached on M-F (10:30 - 7:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (703) 308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7382 for regular communications and (703) 308-7722 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Chris C. Chu  
Examiner  
Art Unit 2815

c.c.  
October 17, 2002



EDDIE LEE  
SUPERVISORY PATENT EXAMINER  
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